

document be tracked by the microprocessor. Therefore, if the user begins to lift the writing instrument too far away from the writing surface, the user is warned by a signal such as an audio beep. The distance above the writing surface can be ascertained, for example, by using a photodetector wherein a drop off in the intensity of the illuminated field below a preset threshold would result in the microprocessor generating a signal to a warning mechanism so as to alert the user that any further distance will result in a loss of positional data required for full function of the device. Preferably, this intensity should correlate to a distance of at least 5 mm or so from the writing surface. If the position within the document is lost, the writer can place the writing device at the last written element and signal to the system, for example, by double depressing the writing tip, in order to identify a reference position within the document and thus regain full function of the device. With restoration of full function, the device can be used once again to make non-writing positional changes for editing, printing, symbol generation, drawing, tabulation, mathematical formulation, and the like. The imaging sample rate of the camera is preferably set at a sufficient frequency such as required to accommodate even a very fast writer. Typically, an image sample rate of 100 hz to 10,000 hz is used. A typical flash memory device can buffer the serial image files if needed in order to be available for analysis by the microprocessor means. The microprocessor determines the serial positional change by comparing the landmarks on the writing surface to the landmarks on the preceding image of the writing surface in order to determine change in direction and distance. The preferred processing power is in the range of 5–25 or more MIPS. The distance and directional data are typical two dimensional vector information that is then stored in a memory device for later transmission. This can be a typical flash memory card.

Subsequent transmission can be via detachable memory chip, wire, or wireless. In the latter case, the mode of transmission can be via infrared, radio frequency, ultrasound, or digital cellular telephony. If the user has access to a digital cell phone, wireless radio frequency transmission from the pen to the digital cellular phone is a preferred embodiment. Regardless of the mode of data transmission from the writing device, the data can be transmitted to any digital device such as a computer, a personal digital assistant (PDA), a netpliance or via the internet to a server. The vector data so generated is conveniently exported to a variety of application programs such as word processing programs, drawing programs, spread sheets, e-mail programs, and the like where it is displayed as written data such as handwriting or printing, or numbers, or formulas, or language symbols such as Chinese. The data can be in ASCII format allowing for easy compression of the files. The conversion of handwritten script information to printed text can be accomplished using a variety of commercially available software programs such as PenOffice (ParaGraph, Inc.). This conversion can occur within the device or in an external digital device such as a personal computer (PC) or a server on the Internet. These handwriting script recognition programs can be self-educating and feature neural networks wherein they improve their accuracy for a specific user by accumulating experience with a variety of words and symbols based upon an individual's edits. If the user is mobile, in particular, and uses a wireless access to the Internet, a preferred embodiment provides a server that stores the individual's handwriting script recognition files for access on the Internet regardless of the users location and independent of the user's access to a computer

device. To provide the energy for lighting, image capture, microprocessor, data storage, and data transmission a battery is preferred.

In another preferred embodiment, the same infrared light source used for illumination can also be used conveniently to provide the wireless transmission of data to a digital device such as a personal computer, laptop, personal digital assistant, netpliance, or cellular digital phone using a commercially available IRT(infrared transmission) port. The camera of the invention can be used to receive communication from the digital device such as personal computer, allowing two-way communication between the invention and the digital device.

In another preferred embodiment, the same camera means used for imaging of the writing surface can also be used conveniently to provide a photodetector means for detecting a subthreshold illumination of the writing surface so as to warn the user that the position within the document could become lost with any further movement of the device away from the writing surface.

In another preferred embodiment, the function of the device includes the elimination by the microprocessor means from the digital copy of any section of the written document that is marked for deletion by the operator. For example, a line through a word would result in deletion of that word from the digital copy. Thus the present invention does not require that the final digital copy of the written document be unedited unless so desired.

In another preferred embodiment, the data transmission means of the present invention can allow for two-way communication between the invention and a digital device such as personal computer, laptop, personal digital assistant, netpliance, digital cellular phone, and the like. In this embodiment, the present invention can provide many of the functions of the digital device. For example, using the audio speaker of the present invention, data downloaded from a digital device can be available to the operator of the present invention. Conversion of digital data to speech is widely available. Moreover, the audio output can be used to monitor the digital data output of the present invention. For example, if the invention is being used to write a prescription, the audio output could confirm the identification of the prescription and the instructions for dispensing and taking the prescription.

In another embodiment of the present invention, the inclusion of a display screen such as an LED (light emitting diode) on the side of the writing device of the present invention provides a convenient means of displaying downloaded digital data as well as data generated by the use of the invention. For example, the download might be a series of questions as for an examination. In another example, the operator may write a prescription and the display shows the data conversion to printed text for confirmation of the prescription.

Variations or modifications to the subject matter of this invention may occur to those skilled in the art upon review of the summary provided herein, in addition to the descriptions of its preferred embodiment, in light of the drawings. Such variations, if within the spirit of this invention, are intended to be encompassed within the scope of the invention as described herein.

What is claimed:

1. A handheld communication device that is used to create a written document and to create a digital copy of said document comprising:  
a writing means;